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Interaction of Highly Charged Ions with C60 Thin Films

T. Schenkel, A. V. Hamza, A. V. Barnes, and D. H. G. Schneider
University of California
Lawrence Livermore National Laboratory
Livermore, CA 94550
USA

Highly charged ions (Au^{69+}, ~2keV/amu) produced by the LLNL electron beam ion trap (EBIT) impinged on a C_{60} thin film vacuum deposited on a Si(100) wafer. These highly charged ions carry a great deal of potential energy, e. g. 160 keV for Au^{69+}, to the thin film. The stability of the molecular, C_{60} cluster upon high electronic excitation is investigated; as is the mechanism of energy dissipation for molecular and cluster targets, which will illuminate the highly charged ion-surface interaction.

The highly charged ion impact induced the desorption and fragmentation of C_{60}. C_{60}^+ is the dominant peak in the positive ion time-of-flight spectrum for C_n, n>30. C_{58}^+, C_{56}^+, and C_{54}^+ were also observed with decreasing intensity. Interestingly, no add-on species (i. e. C_{62}+) could be observed. C_n^+ cluster intensities, for n<30, were observed to decay exponentially with cluster size. In addition C_n^+ clusters with n odd had a higher intensity than C_n^+ clusters with n even.

Surprisingly, negative ion clusters induced by highly charged ion impact were observed in the negative time-of-flight spectrum. No C_{60}^- was observed, suggesting that electron capture during desorption is not an efficient mechanism for highly charged ion-induced desorption. C_n^- cluster intensities, for n<30, were observed to decay exponentially with cluster size with the same factor as the positive ions. C_n^- clusters with n even had a higher intensity than C_n^- clusters with n odd, in contrast to the positive clusters.

The odd-even oscillations are similar to those observed for singly charged ion-induced desorption. However, the decline in the intensity of clusters with cluster size is much more gradual for highly charged ions than for singly charged ions, which is evidence for a electronic sputtering mechanism.

The odd-even oscillations are also similar to those observed upon highly charged ion interaction with highly oriented pyrolytic graphite (HOPG). The behavior of C_{60} thin films with be compared and contrasted to the behavior of HOPG upon highly charged ion impact.

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